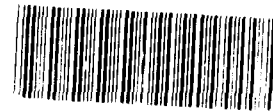


## ENGINEERING-SCIENCE, INC.

1700 Broadway, Suite 900 Denver, Colorado 80290  
phone: (303) 831-8100 • telecopy (303) 831-8208



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### MEETING NOTES

**TO:** Distribution

**DATE:** November 9, 1993

**FROM:** Philip Nixon

**MEMO #:** SP307:111193:01

**PROJECT #:** Solar Pond IM/IRA

**ATTENDANCE:**

**DISTRIBUTION:**

Harlan Ainscough, CDH  
Arturo Duran, EPA  
Mark Austin, EG&G  
Phil Nixon, ES  
Rich Stegen, ES  
Ted Kearns, DOE/KMI  
Frazer Lockhart  
Pat Breen, ES  
Andy Ledford, EG&G  
Vern Witherill, DOE

Attendees  
Richard Henry  
L. Benson  
A. Conklin  
P. Breen  
H. Heidkamp  
K. Cutter  
D. Myers  
S. Stenseng  
A. Fricke  
B. Snyder  
T. Kuykendall  
T. Evans  
B. Cropper  
C. Montes  
B. Wallace, EG&G (Admin.  
Record) [2]  
K. Ruger, EG&G  
K. London, EG&G  
R. Wilkinson  
Steve Howard, DOD/SMS  
Jim Hartman, DOE  
Helen Belencan, DOE  
Ernie O'Tool, DOE/MMES  
Steve Paris, EG&G

**SUBJECT:** Solar Pond IM/IRA Team Meeting

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## 1) Schedule Review

Andy Ledford presented a working schedule for the month of November. He indicated that the schedule was not complete in that the logic ties are still being reviewed, but the internal baseline dates reflect the DOE/EG&G working schedule. Some of the activities are proceeding according to schedule and some of the activities are behind schedule. EG&G is reviewing the logic ties to determine if logic changes need to be made or if management measures need to be taken to get meet the schedule.

Arturo Duran questioned whether the selection of a closure/remediation alternative would be impacted since the data from the ongoing drilling in the B-series ponds would not be available during the detailed analysis of alternatives. Phil Nixon indicated that it would not likely have an impact on the alternative selection; however, the data may be important for determining details of how the selected alternative will be implemented. As previously agreed, the data will likely be included in the second draft of the IM/IRA decision document.

## 2) Liner Issue

Andy Ledford stated that EG&G had added an activity to the schedule which is for the EG&G lawyers to review the technical/legal position for closing the Solar Evaporation Ponds with the liners in-place. Frazer Lockhart indicated that DOE's lawyers recognized that the issue is a gray area with respect to regulatory interpretation, and feel that there may be room for alternative interpretations.

Harlan Ainscough asked whether ES had identified any precedent setting test cases in the State of Colorado. Phil Nixon responded that the investigation was ongoing. A case similar to the OU4 Solar Evaporation Ponds had not been identified where the question of closing ponds similar to a landfill required a Certificate of Designation was challenged. Frazer Lockhart indicated that other sites facing the issue had negotiated a solution to their issues without having to challenge the regulations. Harlan indicated that the CDH has been reviewing their own records and have determined that they have consistently applied the regulations to other facilities closing surface impoundments.

Frazer Lockhart stated that it would be best to have the issue resolved as early as possible so the project could move forward without re-addressing this issue closer to the time of implementation.

## 3) OU9 Old Process Waste Lines (OPWLs)

Steve Hughes discussed the results of the ES background data review for the OU9 OPWLs. He indicated that the lines which are likely to be impacted by the OU4 closure were primarily waste transfer lines to the Solar Evaporation Ponds, from the Solar Evaporation Ponds, and for waste transfer between the Solar Evaporation Ponds.

Therefore, the OU4 RFI/RI characterization data should be adequate for assessing the potential contamination from these lines. It was agreed that OU4 will not be required to implement further characterization studies on these annexed lines.

Frazer Lockhart indicated that a letter had been drafted for submittal to the CDH/EPA to formalize the transfer. OU4 will then have the responsibility to determine how the lines will be addressed. **ES will work with Mark Austin to identify sources of information for all the utilities that are located within the OU4 area and to obtain data to develop and evaluate remedial alternatives for these utilities.**

4) D&D of Building 788

Vern Witherill specified that a decision has been made to delete the D&D of Building 788 from the OU4 Solar Evaporation Pond IM/IRA scope of work so that the removal can be expedited. DOE intends to begin the removal in April/May of 1994 and complete the removal by October/November of 1994 so that the site will be ready for the OU4 Solar Evaporation Pond closure/remediation activities to begin in the spring of 1995. DOE is generally trying to schedule all construction activities in the spring, summer, and fall seasons. Arturo Duran indicated that the D&D schedule is extremely aggressive. A separate meeting will be held to determine whether the removal will be performed according to an IM/IRA decision document or a RCRA Closure plan.

5) Chemicals of Concern

Leigh Benson provided a spreadsheet that listed the COCs for both surficial and vadose zone soils. The table also identifies the COCs that were included due to the historical data. ES committed to add the 95% UCL results for the combined (historical and RFI/RI) and RFI/RI data sets to the table. Harlan Ainscough stated that CDH was having second thoughts about using the 95% UCLs for comparison to PRGs. CDH might prefer to compare the PRGs to the maximum values because maximum values are typically preferred for small data sets. Leigh Benson indicated that the OU4 data set should be large enough such that the 95% UCL is appropriate for use. Frazer Lockhart stated that DOE preferred to use the 95% UCLs because the Gilbert statistical methodology does not include a screen for outlier data points which could result in an unrealistic maximum value. **This issue was left unresolved but ES will develop a path forward for discussion at the next team meeting.**

Amy Conklin asked whether the data analysis activities should focus on the combined data set or only the recent RFI/RI data. It was discussed that the historical data for semi-volatile compounds was suspect and that many of the semi-volatile organic COCs identified for the vadose zone are associated with the historical data and were not detected in the RFI/RI program. Phil Nixon proposed deleting vadose zone COCs that are not COCs in the surficial soil; are vadose zone COCs due to historical data only; and were not detected in the RFI/RI vadose zone samples. This issue was unresolved. **ES**

was tasked to provide a rationale for using the 95% Upper Confidence Limit (UCL) instead of the maximum detected concentration. In addition, ES was tasked to compare the data sets (combined historical and RFI/RI data, to just the RFI/RI data) and recommend an approach for developing a data set for comparison to the PRGs. This will be issued by the close of business on Thursday November 11, 1993 for team review, and for subsequent resolution at the November 15, 1993 team meeting. It is anticipated that Joe Sheffel (CDH) will attend the meeting to participate in this resolution.

6) PRGs

Phil Nixon presented the preliminary results of the PRG calculations for the future onsite resident, the construction worker, and the future worker scenario. It was agreed that the future onsite resident scenario was the appropriate scenario for consideration with respect to surface soils because a formal future land use determination has not been finalized. The future construction worker would be used for the vadose zone soils because onsite residents would not be exposed to vadose zone soils. This approach is consistent with the Risk Assessment Guidance for Superfund (RAGs). **Arturo Duran questioned this approach and will consult with the EPA risk assessment experts on this issue. Frazer Lockhart requested that the CDH and EPA consider what mechanism/document would be acceptable to validate a future land use determination.** DOE is currently conducting a study to determine the land use for the Rocky Flats site.

The PRGs for a few COCs may be established by the background concentrations since it has been agreed that DOE would not be required to remediate to concentrations that are less than background concentrations. **ES will evaluate the background data from Rock Creek with respect to the data from the Background Geochemistry report to see if the Rock Creek results are a reliable source of background data.**

Phil Nixon presented a few preliminary maps for metal and radionuclide COCs in surface soils (maximum concentrations) to show where the OU4 analytical results (historical and RFI/RI) may exceed the calculated PRG or background concentration. It was specified that the maps would likely change because the QA/QC procedure had just been implemented and the 95% UCL data had not been included in the mapping. The preliminary mapping indicated that surficial soil contamination may be present in the immediate vicinity of each of the ponds and in the area north of the ponds. It was discussed that both the DOE and regulatory agencies would benefit if surrounding contaminated soils were consolidated into the Ponds prior to constructing an engineered cover. This would minimize the future migration of the contamination at a reasonable cost by limiting the areal extent of the engineered cover and isolating the contaminated soils from the environment.

Although all parties agreed that consolidating contaminated media under an engineered cover would be mutually beneficial, it was recognized that the regulatory issue of placement could hamper its implementation. In order to effectively implement this strategy, the Corrective Action Management Unit (CAMU) concept would need to be adopted for the OU4 IM/IRA. Harlan Ainscough specified that the CDH had not adopted the CAMU concept and therefore it was not available for use. Although CDH has not formally adopted the CAMU provisions, Rich Stegen indicated that Section 19 of the IAG allows adoption of the CAMU concept outside of the RCRA and CERCLA process. This IAG provision is appropriate since soil remediation should be viewed as a corrective action as opposed to a RCRA closure activity.

Harlan Ainscough specified that CDH might require the removal of some soils at concentrations exceeding the PRGs even though they would be beneath an engineered cover. DOE responded that this would be considered if the risks from leaving the contamination in-place were significant and the contaminants had the potential to be mobile. CDH has not identified the criteria for defining what constituted "significant contamination". **This is an important issue that needs to be resolved and will be included as a future agenda item.**

Harlan Ainscough stated that Joe Sheffel in the CDH risk assessment group was concerned that some TBCs based limits could be more stringent than the PRGs calculated for human health. ES provided tables to Harlan Ainscough identifying exposure limits for ecological protection that were developed for the Lowry Air Force Base in Colorado. These tables were submitted for information only because it was decided at the November 2, 1993 team meeting that chemical specific ARARs/TBCs for ecological receptors would not be considered in the OU4 IM/IRA. It was agreed at that time that the ecology of the site is heavily modified by industrial activities, and that the ecological impacts would be minimal with respect to the OU4 IM/IRA.

#### 7) ARARS

It was agreed that the ARAR table format that was presented at the previous meeting was adequate for the IM/IRA-decision document.

#### 8) Closure Performance Standards/Criteria

It was agreed that the closure performance standards/criteria were developed to add an engineering component to the regulatory requirements, and not to limit the design flexibility. It was agreed that the hazardous waste disposal siting criteria would not be addressed since it was unlikely that such an alternative could be pursued.

9) Technology Development

Phil Nixon distributed a working draft copy of portions of the IM/IRA decision document Part I and Part III for team review. He indicated that this information was developed to provide a basis for the detailed analysis of alternatives and was submitted to keep the team informed. **Comments were requested by November 23, 1993.** The document will be modified to incorporate the results of the detailed analysis of alternatives and to address team comments.

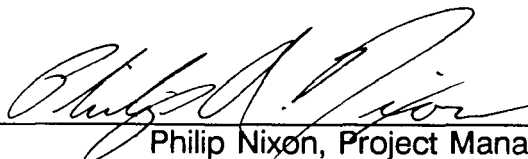
The team reviewed the ES strategy to consolidate the closure/remedial alternatives. Arturo Duran specified that he did not want to spend a great deal of time analyzing alternatives that had a low probability of being selected. P. Nixon responded that the purpose of the consolidation was to try to reduce the level of effort and expedite the detailed analysis of alternatives. **ES will respond to comments on the consolidated alternatives list and continue to use this for the detailed analysis of alternatives.**

10) RFI/RI drilling status

Pat Breen reported that drilling in the B-series Ponds had begun on Saturday November 6, 1993, and was scheduled to be complete by November 11, 1993.

11) Phase II RFI/RI Workplan

Mark Austin presented an outline for the Phase II RFI/RI workplan for team review. Andy Ledford indicated that there is a discrepancy in the IAG dates for the workplan since it is now included as part of the OU4 IM/IRA decision document. The final IM/IRA will not be submitted until late in 1994, whereas the target date to begin the RFI/RI studies is September 1994. This issue will be discussed and resolved at a subsequent meeting after the CDH/EPA have an opportunity to review the schedules and IAG requirements.

  
Philip Nixon, Project Manager

**OU 4 -SOLAR EVAPORATION PONDS  
PHASE I RI/RFI & IM/IRA PROGRAM  
NOVEMBER 15, 1993**

*Attachment 1  
SP 307-11193.01  
page 1051*

**8:00 - 9:00**

1. Chemicals of Concern / PRG's - L. Benson / A. Conklin
  - CDH Concerns With Using The 95% UCL vs Max Value
  - Use of Phase I or Historical Data In Calculations
  - CDH Concerns With Not Using TBC's
  - CDH Concerns With Using Rock Creek as Background

**9:00 - 9:45**

2. CAMU / Movement of Contaminated Media - H. Ainscough / R. Stegen
  - How Far Can It Be Moved
  - Section 19 of The IAG's Application to CAMU

**9:45 - 10:00**

3. Break

**10:00 - 10:15**

4. Schedule Status - A. Ledford

**10:15 - 10:45**

5. Isopleth Map - P. Nixon
  - Extent of Contaminates

**10:45 - 11:15**

6. ARARS - R. Stegen
  - Progress Report

**11:15 - 11:30**

7. Building 788 - A. Ledford
  - Wednesday's Strategy Meeting Brief

**11:30 - 11:45**

8. RFI/RI Drilling Status - R. Henry
  - Completion of B North
  - Status of B Center

**11:45 - 12:00**

9. Remedial Alternatives - P. Nixon
  - Comments on The Early Draft IM/IRA Parts I and III
  - Consolidation of Alternatives

**12:00 - 1:30**

10. Lunch

**1:30 - 2:00**

11. Issue Resolution Methodology
  - Finalized Comments on The Methodology

**2:00 - 2:30**

12. Waste Handling / Disposal - M. Austin
  - How to Address "Liners Removed" Alternatives
    - Interim Storage, Transportation, Disposal Assumptions
    - Cost Estimates & Fatal Flaw Criteria?
  - Removal Of Clarifier

**2:30 - 2:45**

13. New Issues / Next Weeks Agenda

## Remedial Alternatives

- I. No Further Action (1)
  - A. Regrade and seed
  - B. Post-closure monitoring
- II. Containment of Contaminated Materials without Treatment
  - A. Cover systems
    - Backfill and seed (2)
    - Temporary cover (3)
    - Engineered cover (4)
    - Cover alternatives 1-4
  - B. Post-closure monitoring
- III. Containment of Liners with Insitu Soil Treatment (5 & 8)
  - A. Liners
    - No Treatment
    - Partial Dismantling and removal (hot spots)
  - B. Insitu Soil Treatment
    - Solidification
  - C. Cover system
    - Backfill and seed
    - Engineered cover
    - Cover alternatives 1&2
  - D. Post-closure monitoring
- IV. Removal of Contaminated Liners (Partial or Total) (6 & 7)
  - A. Liners (total or hot spots)
    - Containerization
    - Size reduce and containerization
  - B. Soils (total or hot spots)
    - No treatment
    - InSitu treatment
      - solidification/stabilization
      - thermal desorption
  - C. Cover systems
    - Backfill and seed
    - Engineered Cover
    - cover alternatives 1&2
  - D. Post-closure monitoring
  - E. Liner Disposition
    - Disposal
    - Storage
- V. Removal of Contaminated Materials (Partial or Total) With Exsitu treatment (9, 10, and 11)
  - A. Liners (total or hot spots)
    - Containerization
    - Size reduce and containerization
  - B. Soils (total or hot spots)
    - Containerization
    - Exsitu treatment



- solidification/stabilization
- soil washing
- solvent extraction
- degradation
- thermal desorption
- C. Cover systems
  - Backfill and seed
- D. Post-closure monitoring
- E. Liner Disposition
  - Disposal
  - Storage
- F. Soil Disposition
  - Disposal
  - Storage

Notes:

The (#) indicate the preliminary scenarios from Table 3-5.

The cover alternatives 1-4 are described in Section 3.3.2.12

## **OU-4 Solar Evaporation Pond**

### **IM/IRA Decision Document**

#### **Executive Summary**

#### **PART I INTRODUCTION**

- I.1 IM/IRA Objective and Purpose**
- I.2 Site History and OU4 Background**
- I.3 IM/IRA Scope and Assumptions**
- I.4 Site Characteristics and Environmental Setting**
  - I.4.1 Engineered Features and Structures**
  - I.4.2 Demography and Land Use**
  - I.4.3 Topography and Geomorphology**
  - I.4.4 Meteorology, Climatology, and Air Quality**
  - I.4.5 Site and Local Surface Water Hydrology**
  - I.4.6 Site and Local Soils**
  - I.4.7 Regional and Local Geology**
  - I.4.8 Site and Local Hydrogeology**
  - I.4.9 Site and Local Ecology**
  - I.4.10 Site and Local Cultural Resources**

#### **PART II RCRA FACILITY INVESTIGATION/REMEDIAL SETTING**

- II.1. OU 4 Field Investigations**
  - II.1.1 Site Investigations Objectives, and Overview**
  - II.1.2 Summary of Procedural Guidance and Standards Document**
  - II.1.3 Ponds Investigation**
  - II.1.4 Surficial Soils Investigation**
  - II.1.5 Vadose Zone Investigation**
  - II.1.6 Geologic Investigation**
  - II.1.7 Field Investigation Quality Assurance/Quality Control**
- II.2 Results of the RFI/RI Investigation**
  - II.2.1 Results of Ponds Characterization**
  - II.2.2 Surficial Soil Results**
  - II.2.3 Vadose Zone Investigation Results**
  - II.2.4 Geologic Investigation**
  - II.2.5 Quality Assurance/Quality Control**

- II.3 Nature and Extent of Contamination
  - II.3.1 Comparative Guidelines for Contaminant Characterization
  - II.3.2 Solar Evaporation Ponds
  - II.3.3 Surficial Soils
  - II.3.4 Vadose Zone
  - II.3.5 Bedrock
- II.4 Contaminant Fate and Transport
  - II.4.1 Conceptual Model
  - II.4.2 Contaminant Behavior and Mobility
  - II.4.3 Contaminant Processes and Preferential Pathways
- II.5 Summary and Conclusions of the Phase I RCRA Facility Investigation/Remedial Investigation
  - II.5.1 Summary
  - II.5.2 Conclusions

### **PART III INTERIM MEASURE/INTERIM REMEDIAL ACTION DECISION ANALYSIS**

- III.1 Remedial Action Objectives
- III.2 Technology Identification and Screening
  - III.2.1 Review of Potential Technologies
  - III.2.2 Description of Applicable Technologies
  - III.2.3 Identification and Description of Alternative Scenarios
  - III.2.4 Screening Alternative Scenarios
  - III.2.5 Evaluation Criteria for the Detailed Analysis of Alternatives
- III.3 IM/IRA-Alternatives Development
  - III.3.1 Determination of Contaminants/Areas of Concern
  - III.3.2 Identification of Alternatives for Detailed Analysis
- III.4 Risk Analysis
  - III.4.1 Pathways of Exposure
  - III.4.2 Toxicity Assessment
  - III.4.3 Development of Remediation Goals
  - III.4.4 Results of Risk Analysis
- III.5 Detailed Analysis of Alternatives
  - III.5.1 Overall Protection of Human Health and the Environment
  - III.5.2 Compliance with ARARs
  - III.5.3 Long-Term Effectiveness and Permanence

- III.5.4 Reduction of Toxicity, Mobility or Volume through Treatment
- III.5.5 Short-Term Effectiveness
- III.5.6 Implementability
- III.5.7 Cost
- III.5.8 Regulatory Agency Acceptance
- III.5.9 Community Acceptance

#### **PART IV RECOMMENDED IM/IRA ALTERNATIVE**

- IV.1 Description and Rationale for Selection
- IV.2 Conceptual Design
  - IV.2.1 Engineering Design
  - IV.2.2 Implementation Plan and Proposed Schedule
  - IV.2.3 Preliminary Cost Estimate
- IV.3 IM/IRA Risk Analysis and Potential Impact Determination
  - IV.3.1 Human Health Risks
  - IV.3.2 Ecological Risks
  - IV.3.3 Impact to Air Quality
  - IV.3.4 Impact to Water Quality
  - IV.3.5 Impact from the Commitment of Irreversible and Irretrievable Resources
  - IV.3.6 Transportation Impacts
  - IV.3.7 Short Term vs. Long Term Impacts
  - IV.3.8 Impact to Cultural/Historical and Archeological Resources
  - IV.3.9 Cumulative Impacts
- IV.4 Comparative Analysis between the No-Action and Preferred Alternative
- IV.5 Consistency with Final Remedies
- IV.6 Permit Information Summary

#### **PART V POST CLOSURE CARE MONITORING AND MAINTENANCE**

- V.1 Performance Monitoring and Assessment of the Closure
- V.2 Post Closure Care and Monitoring

**PART VI            OPERABLE UNIT 4 RFI/RI WORK PLAN**

- VI.1            Data Evaluation**
  - VI.1.1    Evaluation of Historical Hydrogeological Data**
  - VI.1.2    Evaluation of the Effectiveness of the ITS System**
- VI.2            Data Quality Objectives**
- VI.3            Field Sampling Plan**
- VI.4            Baseline Risk Assessment Work Plan**
  - VI.4.1    Human Health Risk Assessment**
  - VI.4.2    Environmental Evaluation**
- VI.5            Quality Assurance/Quality Control**

- Appendix A       -    Analytical Data**
- Appendix B       -    Applicable or Relevant and Appropriate Requirements**
- Appendix C       -    Identification of Contaminants/Areas of Concern**
- Appendix D       -    Toxicological Profiles for Contaminants of Concern**
- Appendix E       -    Risk Analysis Calculations and other Comparison Criteria**
- Appendix F       -    Design Drawings**
- Appendix G       -    Outline Specification**
- Appendix H       -    Cost Estimate Details**
- Appendix I       -    IM/IRA Responsiveness Summary**

**References**

**RFI/RI Documentation and Pertinent Correspondence**

**List of Agencies and persons contacted**

*Martin*

Table 1 - Proposed Location and Action Specific ARARs/TBCs Identified for the OU4 IM/IRA

ARAR/TBC CITATION	REQUIREMENT DESCRIPTION	IM/IRA ALTERNATIVES <sup>1</sup>				
		1	2	3	4	5
10 CFR 61.7, 61.44 and 61.52	NRC Closure Requirements for Low-Level Radioactive Waste Disposal Sites <sup>2</sup>	---	R&A	R&A	R&A	---
10 CFR 834	DOE Radiation Protection Requirements for Public Health and the Environment <sup>3</sup>	A	A	A	A	A
10 CFR 1022	Evaluate Federal Projects for Potential Floodplain and Wetland Impacts <sup>4</sup>	A	A	A	A	A
29 CFR 1910, Subpart Z	Worker Protection Requirements for Hazardous Waste/Remediation Operations <sup>5</sup>	---	A	A	A	A
36 CFR 65 and 800 National Historical Preservation Act [16 USC 470] CRS 20-80-401	Historic and Archeological Preservation <sup>6</sup>	A	A	A	A	A
40 CFR 50.6 and 50.7	NAAQS, Particulate Matter <sup>7</sup>	A	A	A	A	A
40 CFR 61, Subpart H	NESHAPS, Radionuclide Emissions <sup>7</sup>	---	A	A	A	A
40 CFR 122.26	NPDES Stormwater Management Requirements	A	A	A	A	A
40 CFR 262.12 6 CCR 1007-3, 262.12	Hazardous Waste Determinations	---	---	---	A	A
40 CFR 262, Subparts B and C; 40 CFR 263, Subpart B 6 CCR 1007-3, 262, Subparts B and C; 6 CCR 1007-3, 263, Subpart B	Off-Site Transport of Hazardous Waste <sup>8</sup>	---	---	---	A	A
40 CFR 262, Subpart D 6 CCR 1007-3, 262, Subpart D	Generator Record Keeping and Reporting <sup>9</sup>	---	---	---	A	A
40 CFR 264, Subpart B 6 CCR 1007-3, 264, Subpart B	General Standards for Hazardous Waste Facilities <sup>10</sup>	---	---	---	A	A

ARAR/TBC CITATION	REQUIREMENT DESCRIPTION	IM/IRA ALTERNATIVES <sup>1</sup>				
		1	2	3	4	5
40 CFR 264, Subpart D 6 CCR 1007-3, 264, Subpart D	Preparedness and Prevention for Hazardous Waste Facilities <sup>10</sup>	---	---	---	A	A
40 CFR 264, Subpart F 6 CCR 1007-3, 264, Subpart F	Groundwater Protection and Monitoring <sup>11</sup>	---	A	A	A	---
40 CFR 264, Subpart I 6 CCR 1007-3, 264, Subpart I	Requirements for Container Management and Storage	---	---	---	A	A
40 CFR 264, Subpart J 6 CCR 1007-3, 264, Subpart J	Requirements for the Treatment and/or Storage of Hazardous Waste in Tanks <sup>12</sup>	---	---	---	A	A
40 CFR 264.552 and 264.553	Establishment of CAMUs and Temporary Units to Facilitate Corrective Actions <sup>13</sup>	---	R&A	R&A	R&A	R&A
40 CFR 265, Subpart B 6 CCR 1007-3, 265, Subpart B	General Standards for Interim Status Hazardous Waste Facilities <sup>14</sup>	A	A	A	A	A
40 CFR 265.111 6 CCR 1007-3, 265.111	Interim Status Facility Closure Standards	A	A	A	A	A
40 CFR 265.113 6 CCR 1007-3, 265.113	Time allowed for Closure	A	A	A	A	A
40 CFR 265.114 6 CCR 1007-3, 265.114	Disposal or Decontamination of Equipment Structures and Soils	---	A	A	A	A
40 CFR 265.115 and .116 6 CCR 1007-3, 265.115 and .116	Certification of Closure and Survey Plat	---	A	A	A	---
40 CFR 265.117 to .120 6 CCR 1007-3, 265.117 to .120	Post-Closure and Use of Property	---	A	A	A	---
40 CFR 265.228 <sup>14</sup> 6 CCR 1007-3, 265.228	Closure and Post-Closure Care for an Interim Status Surface Impoundment	A	A	A	A	A
40 CFR 268, Subpart A to D 6 CCR 1007-3, 268, Subpart A to D	Land Disposal Restrictions and Treatment Standards <sup>15</sup>	---	---	---	A	A
40 CFR 268, Subpart E 6 CCR 1007-3, 268, Subpart E	Prohibition on Storage of Restricted Waste	---	---	---	A	A

ARAR/TBC CITATION	REQUIREMENT DESCRIPTION	IM/IRA ALTERNATIVES <sup>1</sup>				
		1	2	3	4	5
40 CFR 300.440 [Reserved] CERCLA 121(d)(3)	Procedures for Planning and Implementing Off-site Response Actions <sup>8</sup>	---	---	---	A	A
49 CFR 172, Parts B to F; 49 CFR 173, Parts B to O; 49 CFR 177	Off-Site Transport of Hazardous Waste <sup>8</sup>	---	---	---	A	A
50 CFR 402 16 USC 1531 - Endangered Species Act CRS 33-2-101	Evaluate Federal Projects for Potential Impact to Endangered or Threatened Species or Critical Habitats	A	A	A	A	A
DOE Order 5480.11, Section 9 10 CFR 835 (Proposed)	Occupational Radiation Protection Standards <sup>16</sup>	TBC	TBC	TBC	TBC	TBC
DOE Order 5400.5, Chapter IV	Residual Radioactive Material in Soil	TBC	TBC	TBC	TBC	TBC
DOE Order 5480.3	Packaging and Transportation Requirements for Radioactive Materials <sup>8</sup>	---	---	---	TBC	TBC
DOE Order 5483.1A 29 CFR 1926	Occupational Health Standards for General Construction Activities <sup>17</sup>	TBC	TBC	TBC	TBC	TBC
DOE Order 5820.2A, Chapter III	Low-Level Radioactive Waste Management	---	TBC	TBC	TBC	TBC
Executive Order 11988	Floodplain Management - Federal Facilities	TBC	TBC	TBC	TBC	TBC
Executive Order 11990	Protection of Wetlands - Federal Facilities	TBC	TBC	TBC	TBC	TBC
NRC Regulatory Guide 1.86	Residual Radioactive Material as Surface Contamination	TBC	TBC	TBC	TBC	TBC

1. The IM/IRA Remedial Alternatives are as follows:

- 1 - No Further Action
- 2 - Containment of Contaminated Materials without Treatment
- 3 - Containment of Liners with In-situ Soil Treatment
- 4 - Removal of Contaminated Liners (Partial or Total)
- 5 - Removal of Contaminated Materials (Partial or Total) with Ex-situ Treatment or Containerization

2. These regulatory requirements would be Relevant and Appropriate if radiological contamination exists. Only those standards which relate to closure activities would be included.

Attachment 5  
SP 307-1119301  
Page 3 of 5



3. This regulation was recently promulgated by the DOE to control radiation exposures for the protection of public health and the environment. NRC also has similar protection standards promulgated under 10 CFR 20.1301. Since the DOE standards are applicable and are consistent with the NRC, which would be relevant and appropriate, the DOE standards is the only ARAR identified for compliance purposes.
4. Although no wetlands are expected to be impacted, all Federal actions are required to be assessed.
5. Although OSHA standards are not considered ARARs (see 55 FR 8680), 40 CFR 300.150 specifically requires that all response actions under the NCP to maintain worker safety and health as specified under 29 CFR 1910.120. This regulation is being listed for completeness and to ensure that these protection requirements are not overlooked when preparing the implementation plans for the selected IM/IRA alternative.
6. Although no historic and archeological sites are expected to be impacted, all Federal actions are required to be assessed.
7. This standard would involve the control of fugitive particulates during regrading and/or excavation activities.
8. These requirements would only be applicable in the case where hazardous waste is shipped off-site.
9. Recording keeping requirements are not normally considered to be ARARs since they are not a substantive requirements. However, off-site actions response actions must comply with all applicable regulations both substantive and procedural. The generator record keeping and reporting requirements would only be applicable in the case where hazardous waste is shipped off-site.
10. These requirements would only be applicable should a new hazardous waste storage or treatment facility be constructed as part of the IM/IRA alternative. These requirements would address the operation of the storage and treatment facility only. Should waste materials be stored or treated within existing on-site facilities, the management and control of the waste is outside the scope of this IM/IRA and would be the responsibility of the storage/treatment facility custodian.
11. Post-closure groundwater monitoring is required for a "dirty" closed surface impoundment unless the owner/operator can demonstrate that groundwater monitoring is not necessary. The groundwater monitoring requirements will be addressed in the Post-Closure Permit.
12. These requirements would only be applicable if hazardous waste is to be stored or treated in a tank.
13. On February 16, 1993, the EPA promulgated final rules for Corrective Action Management Units (CAMUs) and Temporary Units (TUs) to promote more expeditious clean-ups at many sites. In States where the EPA administers the RCRA program, the Regional Administrator may designate a CAMU or TU for remediation waste to allow a more flexible management of these waste to be protective of human health and the environment. CAMUs/TUs allow the consolidation, storage, and treatment of remediation waste without having to fully comply with LDR treatment standards, minimum technology requirements or permitting aspects if compliance with these standards could result in an ineffective remediation program. Authorized States are not required to adopt the CAMU/TU rule as part of the State hazardous waste management program; however, EPA strongly encourages that States adopt these final rules. Currently, the State of Colorado has not

adopted the CAMU/TU rule; however. Paragraph 19 of the IAG states, "When Corrective Action regulations are promulgated and become effective, the Parties agree to amend the Statement of Work as necessary to incorporate such regulatory requirements. Prior to such amendment, should any activity at an OU identified as a State lead reach the corrective action stage, DOE and the State will utilize the CERCLA remedial action process." It should be noted that the CERCLA remedial process is based on a similar CAMU/TU concept which allows the establishment of Areas of Contamination and exempts on-site response actions from needing to obtain permits for activities associated with the management of remediation waste. The provisions for a CAMU/TU would allow be required if the IM/IRA alternative involves the consolidation of contaminated media (if designated as a hazardous waste) to improve containment design, and/or for the on-site treatment or storage of the remediation waste (if designated as a hazardous waste).

14. Interim status operational requirements apply to hazardous waste facilities until they are certified as being closed. Security, training and inspection programs will need to be maintained and revised, if necessary, to ensure that public health and the environment are adequately protected during the closure activities.
15. In addition to complying with the required treatment standards for the land disposal of any designated hazardous waste, off-site shipments will need to be certified as required.
16. Although occupational worker standards are not consider to be ARARs/TBCs, the citation to the DOE Radiation Protection Program is being provided for completeness and to ensure that these protection requirements are not overlooked when preparing the implementation plans for the selected IM/IRA alternative.
17. Although OSHA standards are not considered ARARs (see 55 FR 8680), such non-environmental OSHA requirements would apply on their own applicability. These OSHA standards apply to Federal facilities by Executive Order ??; however, they are not independently enforced by OSHA. These occupational safety requirements are adopted and implemented under DOE Order 5483.1A. This regulation is being listed for completeness and to ensure that these protection requirements are not overlooked when preparing the implementation plans for the selected IM/IRA alternative.

Attachment 5  
SP307:111193.01  
page 1 of 14

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT
40121100	EXECUTED VERTICAL DRILLING	14DEC92A	21APR93A	45	0	
40121200	207B NORTH & CENTER DRILLING	21OCT93A	2FEB94	72	56	66
40121211	PRE-MOBILIZATION (207BN & CNTR)	21OCT93A	29OCT93A	5	0	
40121212	P A MOBILIZE (207BN & CNTR)	26OCT93A	28OCT93A	1	0	
40121213	CRANE SUPPORT (207BN & CNTR)	4NOV93A	4NOV93A	1	0	
40121221	DRILLING (207B NORTH)	5NOV93A	12NOV93	10	1	1
40121222	DRILLING (207B CENTER)	15NOV93	30NOV93	10	10	1
40121231	CORE LOGGING (207B NORTH)	12NOV93	25JAN94	45	45	72
40121232	CORE LOGGING (207B CENTER)	22NOV93	2FEB94	45	45	66
40121241	DENOBILIZATION (207BN & CNTR)	1DEC93	7OCC93	5	5	106
40121400	CONSTRUCTION MANAGEMENT	14DEC92A	3FEB94	280	52	65
40121500	VAD05E ZONE INVESTIGATION	26APR93A	30SEP93A	80	0	
40131000	LAB ANALYSIS TURNAROUND	12DEC92A	11JAN94	264	35	5
40131100	RAD (EXECUTED DRILLING)	12DEC92A	22OCT93A	45	0	
40131200	NON RAD (EXECUTED DRILLINGS)	21DEC92A	22OCT93A	61	0	
40131300	RAD (VAD05E)	3MAY93A	15OCC93	61	22	2
40131400	NON RAD (VAD05E)	3MAY93A	6JAN94	76	32	2
40131500	RAD (207B NORTH)	8NOV93A	22OCC93	31	27	7
40131600	NON RAD (207B NORTH)	8NOV93A	22OCC93	31	27	7
40131700	RAD (207B CENTER)	18NOV93	11JAN94	31	31	1
40131800	NON RAD (207B CENTER)	18NOV93	11JAN94	31	31	5
40132000	DATA VALIDATION	21DEC92A	15MAR94	304	80	37
40132100	EXECUTED VERTICAL DRILLING (VALIDATION)	21DEC92A	11JAN94	90	35	82
40132200	207B NORTH (VALIDATION)	12NOV93	9MAR94	76	76	41

RCRA FACILITY INVESTIGATION

FIELD INVESTIGATION

LAB ANALYSIS

EG&G ROCKY FLATS

OPERABLE UNIT #04

SOLAR PONDS REMEDIATION

Sheet 1 of 14

Activity: Early Start, Early Finish, Original Duration, Remaining Duration, Total Float

Legend: Activity Bar/Early Date, Critical Activity, Progress Bar, Target Date, Milestone/Flag Activity

Target Date: 5NOV93  
Plot Date: 12NOV93  
Data Date: 12NOV93  
Project Start: 1DEC92  
Project Finish: 15JUN95

(c) Primavera Systems, Inc.



ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT	1993												1994												1995																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
							OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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40211000	REQUEST FOR PROPOSAL (BASELINE)	21JUN93A	1JUL93A	10	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

Sheet 3 of 14

EG&G ROCKY FLATS  
OPERABLE UNIT #04  
SOLAR PONDS REMEDIATION

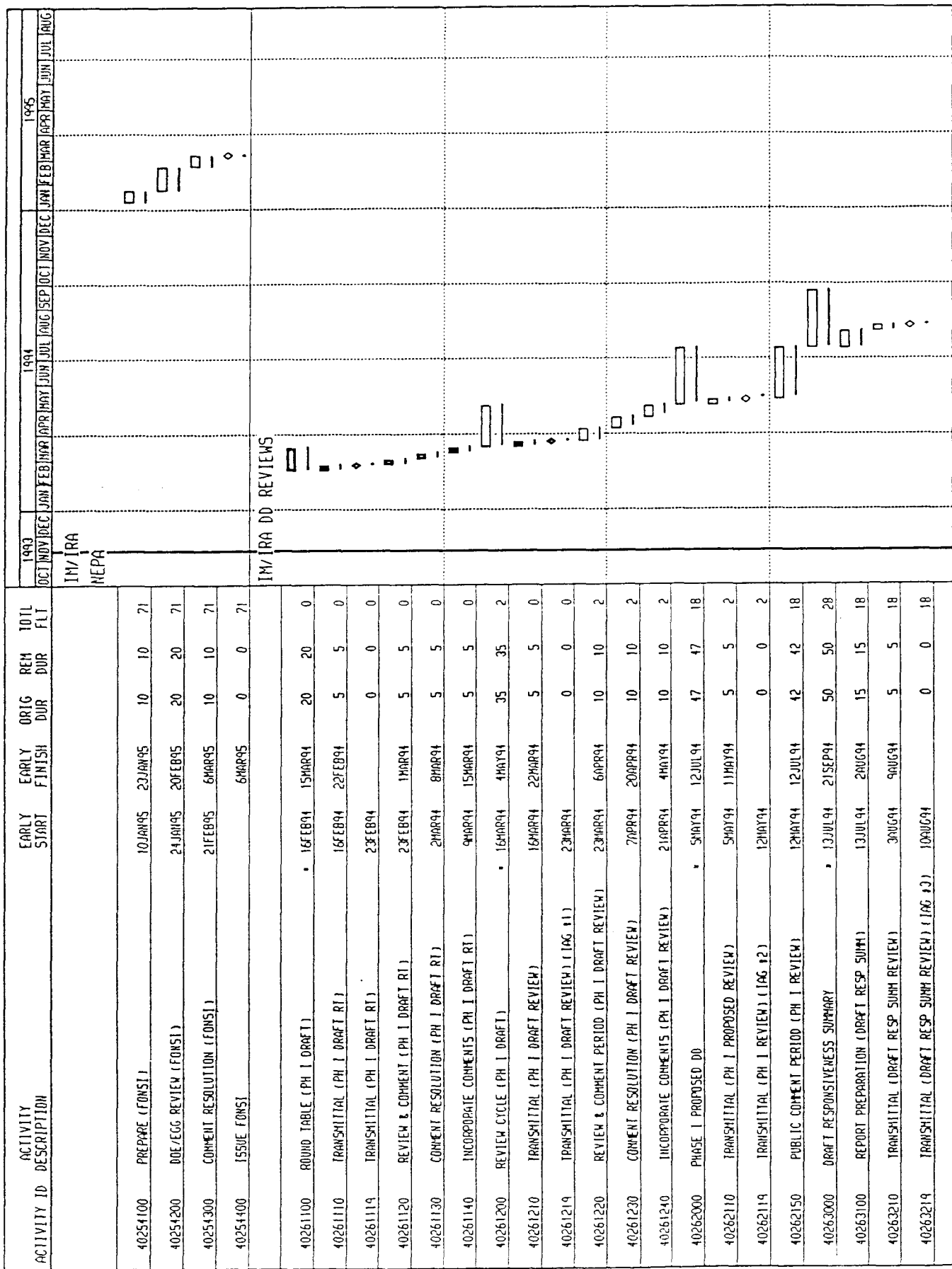
SWC

Activity Bar/Early Dates	Activity Bar/Early Dates
Critical Activity	Critical Activity
Progress Bar	Progress Bar
Target Date	Target Date
Initiation/Fin Activity	Initiation/Fin Activity
○/○	○/○

Target Date 5NOV93  
Plot Date 12NOV93  
Data Date 12NOV93  
Project Start 10DEC92  
Project Finish 15JUN95  
E.C. Primavera Systems, Inc.

Date	Revision	Checked	Approved





Activity	Bar/Early Dates	Activity	Bar/Early Dates
Target Date	12/01/93	Progress Bar	12/01/93
Plot Date	12/01/93	Target Date	12/01/93
Data Date	12/01/93	Milestone/Flag Activity	12/01/93
Project Start	10/01/92		
Project Finish	12/01/93		

ACTIVITY ID DESCRIPTION			ACTIVITY		EARLY START		EARLY FINISH		ORIG DUR		REM DUR		TOTL FLT
40263220	REVIEW & COMMENT PERIOD (DRAFT RESP SUMM RVM)		10AUG94	23AUG94	10	10	28						
40263230	COMMENT RESOLUTION (DRAFT RESP SUMM REVIEW)		24AUG94	7SEP94	10	10	28						
40263240	INCORPORATE COMMENTS (DRAFT RESP SUMM REVIEW)		8SEP94	21SEP94	10	10	28						
40264000	FINAL IM/IRA DD & RESPONSIVENESS SUMMARY		22SEP94	9JAN95	70	70	111						
40264110	TRANSINITIAL (FINAL DD & RESP SUMM RVM)		22SEP94	28SEP94	5	5	28						
40264119	TRANSINITIAL (FINAL DD & RESP SUMM RVM TAG #1)		24SEP94		0	0	28						
40264140	EPA/CDH APPROVAL (FINAL DD & RESP SUMM RVM)		3JAN95	9JAN95	5	5	64						
40264149	EPA/CDH APPROVAL (FINAL DD & RESP SUMM RVM)		9JAN95	9JAN95	0	0	64						
40264200	PUBLIC REPORTING		9JAN95	9JAN95	0	0	111						
DIRECT PROJECT SUPPORT													
40271000	PROGRAM/PROJECT MANAGEMENT		21JUN94	9JAN95	380	282	64						
40272000	PROJECT ENGINEER		10CT93A	9JAN95	380	282	64						
40273000	REGULATORY SUPPORT		10CT93A	9JAN95	380	282	64						

EC&G ROCKY FLATS  
OPERABLE UNIT #04  
SOLAR PONDS REMEDIATION

Sheet 6 of 11

Target Date 5NOV93  
Plot Date 12NOV93  
Data Date 12NOV93  
Project Start 1DEC92  
Project Finish 15JUN95

Activity Bar/Early Dates  
Critical Activity  
Progress Bar  
Target Dates  
Milestone/Flag Activity

C/P

Date Revision Checked Approved



ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT
40310000	CONCEPTUAL DESIGN 40%	17DEC93	24JAN94	26	26	11
40311000	40 % DRAWINGS	17DEC93	7JAN94	15	15	11
40312000	40 % SPECIFICATIONS	10JAN94	21JAN94	10	10	11
40313000	40% SCHEDULE	10JAN94	21JAN94	10	10	12
40314000	40% COST ESTIMATE	11JAN94	24JAN94	10	10	11
40331000	CD PROGRAM/PROJECT MANAGEMENT SUPPORT	17DEC93	20JAN94	24	24	13
40332000	CD PROJECT ENGINEER	17DEC93	20JAN94	24	24	13

1993

OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG

1994

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG

1995

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG

CONCEPTUAL DESIGN

40% CONCEPTUAL DESIGN

DIRECT PROJECT SUPPORT

Target Date

Plot Date

Data Date

Project Start

Project Finish

5/10/93

12/10/93

12/10/93

10/1/93

15/10/93

Activity Bar/Early Dates

Critical Activity

Progress Bar

Target Dates

Milestone/Flag Activity

EG&G ROCKY FLATS

OPERABLE UNIT #04

SOLAR PONDS REMEDIATION

Sheet 7 of 11

ACTIVITY ID DESCRIPTION		ACTIVITY		EARLY START	EARLY FINISH	ORIG DUR	REH DUR	TOTL FLT	1993												1994												1995																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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ACTIVITY ID	DESCRIPTION	ACTIVITY	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT												
40141009	TRANSITTIAL (IMPLEMENTATION DOCUMENT) (TAG #5)	2INDV94	0	0	0	2													
40142000	REVIEW & COMMENT (TITLE II)	2INDV94	13DEC94	15	15	52													
40143000	COMMENT RESOLUTION (TITLE II)	14DEC94	4JAN95	10	10	52													
40144000	INCORPORATE COMMENTS (TITLE II)	5JAN95	18JAN95	10	10	52													
40145000	APPROVAL (TITLE II)	22FEB95	28FEB95	5	5	28													
40161000	PROGRAM/PROJECT MANAGEMENT	23MAR94	25JAN95	209	209	52													
40162000	PROJECT ENGINEER	23MAR94	25JAN95	209	209	52													

TITLE II DESIGN  
TITLE II REVIEW CYCLE

DIRECT PROJECT SUPPORT

EG&G ROCKY FLATS  
OPERABLE UNIT #04  
SOLAR PONDS REMEDIATION

Page 4 of 11

Date	Revision	Checked	Approved

Target Date 5/4/93  
Plot Date 12/8/93  
Data Date 12/8/93  
Project Start 10EC92  
Project Finish 15JUN95

(C) Primavera Systems, Inc.

Activity Bar/Lines:  
Critical Activity  
Progress Bar  
Start Date  
Milestone Tag  
○ / ●

DATE



ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR	REH DUR	TOTL FLT	1993												1994												1995											
							OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG													
40551000	BUILDING 788 D & D OVERSITE	10CT193A	30SEP94	219	219	174																																				
							PRE-CONSTRUCTION																																			
							BUILDING 788 D & D OVERSITE																																			
							DIRECT PROJECT SUPPORT																																			
40581000	PROGRAM/PROJECT MANAGEMENT	10CT193A	8JUN95	418	388	5																																				
40583000	QA/QS	10CT193A	8JUN95	418	388	5																																				
40584000	PROJECT ENGINEER	10CT193A	8JUN95	418	388	5																																				

Target Date  
12NOV93  
Data Date  
12NOV93  
Project Start  
10DEC92  
Project Finish  
15JUN95

Activity Bar/Early Dates  
Critical Activity  
Progress Bar  
Target Dates  
Milestone/Flag Activity

O/R

Div2

EG&G ROCKY FLATS  
OPERABLE UNIT #04  
SOLAR PONDS REMEDIATION

Sheet 11 of 14

199319941995

OCTNOVDECJANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDECJANFEBMARAPRMAYJUNJULAUG



ACTIVITY ID DESCRIPTION		ACTIVITY	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT
40634340	PUBLIC COMMENT OF PST CLSR PREFRNC & ASSESSMEN	12MAY94	12JUL94	42	42	179	
40634400	DRAFT FINAL POST CLOSURE PERFORMANCE ASSESSMENT	12MAY94	12JUL94	42	42	179	
40634410	PREP FINAL DRAFT PST CLSR PREFRNC & ASSESSMENT	12MAY94	5JUL94	37	37	33	
40634420	SUBMIT DRAFT FINAL PST CLSR PREFRNC & ASSESSMENT	6JUL94	5JUL94	0	0	33	
40634430	TRANSMT DRAFT FINAL POST CLOSURE PERFORMANCE ASSESSMENT	6JUL94	19JUL94	10	10	33	
40634500	FINAL POST CLOSURE PERFORMANCE ASSESSMENT	29JUL94	21SEP94	38	38	33	
40634510	PREP FINAL POST CLOSURE PERFORMANCE ASSESSMENT	29JUL94	7SEP94	28	28	33	
40634520	SUBMIT FINAL POST CLOSURE PERFORMANCE ASSESSMENT	8SEP94	7SEP94	0	0	33	
40634530	TRANSMT FINAL POST CLOSURE PERFORMANCE ASSESSMENT	8SEP94	21SEP94	10	10	33	
40660000	PROGRAM/PROJECT MANAGEMENT SUPPORT	19AUG94	28FEB95	378	318	28	

Legend:

- Activity Bar/Early Date
- Critical Activity
- Program Bar
- Project Bar
- Initiation/Fin Activity

Target Date: 5/00/93  
 Plot Date: 12/00/93  
 Data Date: 12/00/93  
 Project Start: 10/00/92  
 Project Finish: 15/00/95

Activity Bar/Early Date  
 Critical Activity  
 Program Bar  
 Project Bar  
 Initiation/Fin Activity

EG&G ROCKY FLATS  
 OPERABLE UNIT #04  
 SOLAR PONDS REMEDIATION

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR	REM DUR	TOTL FLT	1993												1994												1995											
							OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG													
							PHASE II RCRA FACILITY INVESTIGATION																																			
							PROCURE SUBCONTRACT																																			
							WORK PLAN																																			
40711000	REQUEST FOR PROPOSAL	28JUL93A	27AUG93A	20	0																																					
40712000	PROPOSAL	27AUG93A	28SEP93A	15	0																																					
40713000	TECHNICAL EVALUATION	25OCT93A	1NDV93A	10	0																																					
40714000	COST EVALUATION	29OCT93A	12NOV93	10	1	4																																				
40715000	LETTER CONTRACT	12NOV93	12NOV93	1	1	4																																				
40716000	NEGOTIATIONS	15NOV93	7DEC93	15	15	39																																				
40717000	AWARD	8DEC93		0	0	39																																				
							PRE-FIELD INVESTIGATION ACTIVITIES																																			
40721000	PROJECT SCOPING	15NOV93	30NOV93	10	10	4																																				
40722000	WORK PLAN DEVELOPMENT	15NOV93	2FEB94	50	50	4																																				
40722109	SUBMIT PHASE II DRAFT WORK PLAN (TAG #7 INTERNAL)	23MAR94		0	0	0																																				
40722209	SUBMIT PHASE II DRAFT WORK PLAN (TAG #7 EXTERNAL)	14APR94		0	0	0																																				
40722210	INCORPORATE COMMENTS PH II PLAN	15APR94	23JUN94	49	49	1																																				
40722309	SUBMIT PHASE II FINAL WORK PLAN (TAG #7 EXTERNAL)	24JUN94		0	0	0																																				
							DIRECT PROJECT SUPPORT																																			
40730000	MOBILIZATION	1AUG94	7OCT94	49	49	169																																				
40731000	PERMITS	1AUG94	26SEP94	40	40	178																																				
40732000	HEALTH & SAFETY PLAN	1AUG94	26SEP94	40	40	178																																				
40733000	TRAINING	1AUG94	26SEP94	40	40	178																																				
40740000	QA/QC	12NOV94	7OCT94	40	40	169																																				
40741000	PROJECT MANAGEMENT SUPPORT	1OCT93A	7OCT94	291	224	169																																				
40742000	GEOSCIENCES	1OCT93A	7OCT94	291	224	169																																				
40743000	QA/QC	28JUL93A	7OCT94	291	224	169																																				